means to overcome the foundational difficulties that plague (legal) justification.[3] The open nature of the law makes the outcomes of legal procedures indeterminate. I will argue in section 7 that, as a consequence, the law in concrete cases depends on the decision making procedure, without an independent standard for the correctness of this outcome. In other words, the law is the result of a procedure and dialogues are a promising way to model such a procedure.

My purpose in this chapter is to give an overview of dialectical models as they are used in the field of Artificial Intelligence and Law and the closely related fields of logic and legal theory and to distinguish between the different functions that these systems fulfill.[4] I will distinguish between three main functions, which will be discussed in turn. In the sections 2 to 4 I discuss dialectical garbs for what is essentially a definition of logical validity. In the sections 5 and 6 the topic is dialogical approaches to the establishment of the premises of arguments. The sections 7 to 11 deal with the dialogical, or, more generally, procedural, determination of the law in concrete cases. This chapter is summarized in section 12.

2. THE PIONEERING WORK OF LORENZEN AND LORENZ

In their *From Axiom to Dialogue*, Barth and Krabbe distinguish three dimensions of logic systems.[5] One is the dimension of *syntax*. Important characteristics of a logic are the number and nature of the logical constants, the way in which the lexicon is divided into categories, such as terms and relations and the ways in which sentences are constructed from elements of the lexicon.

The second dimension is the dimension of logical strength. Even given a fixed syntax, a logic may have more or less derivational power. Barth and Krabbe distinguish between (in increasing power) minimal, constructive (intuitionistic) and classical (propositional) logic, but for the purpose of Law and AI, non-monotonic logics are relevant too, as even stronger than classical logic.[6]

[3] Alexy 1978, 221f.

[4] Dialectical approaches are also important in other fields. See e.g. Hamblin 1970, 253f. and Bench-Capon et al. 1992.

[5] Barth and Krabbe 1982, 3-13.

[6] Non-monotonic logics will usually have a different syntax than propositional logic and in this respect, the comparison is not fully correct.

The third dimension, which is the most important for this chapter, is the dimension of garb. The 'same' logic can be presented in different forms. Barth and Krabbe distinguish between, amongst others, axiomatic, model-theoretic and dialectical presentation of a logic. In my discussion of dialectical garbs for logical theories, I will deal with two ways in which a dialectical presentation of a logic can be fruitful. First comes the seminal work of Lorenzen and Lorenz, to illustrate some of the basic ideas behind the dialectical approach. Second, I will show how the dialectical garb can be used to model the defeasible nature of reasoning with rules and principles.

2.1 Validity as the outcome of a winning strategy

In their *Dialogische Logik*, Lorenzen and Lorenz show how it is possible to characterize logical validity in terms of critical dialogues, rather than by means of axioms or truth tables.[7] Let me illustrate their approach by means of two examples. The setting of the examples is that there are two dialogue parties, called P (proponent) and O (opponent). Both parties have an associated set of sentences (possibly empty) to which they are committed. Commitment means that parties are not allowed to attack sentences to which they are committed. P makes a claim and O is allowed to attack this claim, thereby forcing P to defend it. There are rules governing this game of attacking and defending and these rules are related to the logical operators. The basic idea is that a sentence `S` logically follows from a set of sentences `Premises`, if P has a winning strategy to defend `S` on the assumption that O is committed to the sentences in `Premises`.

Suppose that O is committed to the sentence `C` and that P has claimed the sentence `A` $\rightarrow$ `(B` $\vee$ `C)`. The rules that define the logical operators (see section 2.2) specify how such a claim can be attacked. For the present example they imply that O must attack this claim by claiming `A`. This creates for P the obligation to claim `B` $\vee$ `C` (or to attack `A`). The sentence `B` $\vee$ `C` can be accepted by O, in which case P has succeeded in defending his original claim. However, O can also attack `B` $\vee$ `C`. In that case P must claim either `B` or `C`. In our example, P would be wise to claim `C`, because O is committed to that sentence and is therefore not allowed to attack it. If P claims `C`, he wins the dialogue and his original claim holds good. If P defends `B` $\vee$ `C` by claiming `B`, however, O can attack `B` and then P loses the dialogue because he has no way to defend this claim. The following table illustrates the first version of this brief dialogue.[8]

[7] Lorenzen and Lorenz 1978.

[8] The example does not follow the syntax of Lorenzen and Lorenz.

P	O
claim: A → (B ∨ C)	claim: A
claim: B ∨ C	? B ∨ C
claim: C	is committed to C and loses the dialogue

The second version of the argument would run as follows:

P	O
claim: A → (B ∨ C)	claim: A
claim: B ∨ C	? B ∨ C
claim: B	? B
has no additional defense and loses the dialogue	

As the different outcomes of the two dialogues concerning the same claim illustrate, the validity of a claim, given the commitments of the opponent, does not guarantee that the proponent wins the dialogue. However, it does guarantee that the proponent has a winning strategy (cf. version 1). It would be more in the spirit of Lorenzen and Lorenz to turn this around and say that a claimed sentence logically follows from the commitments of the opponent, if the proponent has a winning strategy. Whether he actually uses that strategy in a dialogue does not matter.

2.2 Dialectical characterization of logical operators

Lorenzen and Lorenz do not only give a dialectical characterization of valid conclusions; the meanings of the logical operators are also defined in terms of their dialectical use. I will illustrate this by means of the dialectical characterization of the operators of propositional logic.[9]

CONJUNCTION

If P claims A & B, O can attack this claim by ?l and ?r. ?l may be read as 'Is the left conjunct true?' and ?r as 'Is the right conjunct true?' This attack imposes on P the duty to defend the conjunction by claiming respectively A or B.

[9] Lorenzen and Lorenz 1978, 38.

P	O	P
A & B	?l	A
	?r	B

DISJUNCTION
If P claims A ∨ B, O can attack this claim by ?. This attack imposes on P the duty to defend the disjunction by claiming either A or B.

P	O	P
A ∨ B	?	A
		B

IMPLICATION
If P claims A → B, O can attack this claim by claiming A. This attack imposes on P the duty to defend the implication by claiming B, or by attacking A.[10]

P	O	P
A → B	A	B

NEGATION
If P claims A, O can attack this claim by claiming ~A. If this happens, P has lost the dialogue game. However, O is only allowed to make this attack if he was not committed to A.

P	O
A	~A

2.3 Some characteristics of the Dialogische Logik

There are four characteristics of the approach of Lorenzen and Lorenz to which I want to draw the reader's attention, because they are important in relation to the other work that will be discussed.

a) *The dialogue steps correspond approximately to the steps within a single argument*. If the dialogue games are compared to proofs in syntactic renderings of logic, a dialogue move together with the

[10] If O succeeds in defending A, P still has the duty to defend the implication by claiming B.

answer to it are the counterpart of a proof step. For instance, in the proof theory of propositional logic it is possible to derive `A ∨ B` from `A` in one step. The dialogical version of this step is that the claim that `A ∨ B` is questioned and then defended by claiming `A`.

b) This correspondence can be explained by the fact that the traditional proof steps are based on the meanings (semantics) of the logical operators, while these same meanings are in the view of Lorenzen and Lorenz defined by the dialogue rules that are attached to them. *The dialogue rules reflect the logical meanings of the operators, or the other way round.*

c) *To determine whether a sentence follows from other sentences, it is necessary to consider all possible dialogues.* It is possible to make mistakes in arguing for a conclusion and as a consequence it is impossible to define the validity of a conclusion given a set of premises in terms of the actual reasoning behavior of dialogue parties. That is why the definition of logical validity makes use of all possible dialogue games, by working with the notion of a winning strategy.

d) *The dialogue games assume a fixed set of commitments (premises).* This is a consequence of the fact that the dialogues aim at characterizing the notion of logical consequence. It does not matter whether the conclusion of a dialogue or a winning strategy is true or false; the only thing that matters is whether the conclusion follows from a set of premises. That is why the notion of a winning strategy presupposes a set of premises for which this strategy exists. Winning strategies are relative to a set of commitments, just like valid conclusions are relative to a set of premises.

This ends the description of the seminal work of Lorenzen and Lorenz, which deals with the dialectical characterization of the logical operators and of logical validity. In the next section we will see that dialectics can also be used to model a quite different aspect of reasoning, namely its defeasibility.

3. DEFEASIBILITY AND DIALECTICS

Most legal reasoning is based on the application of rules and principles. This even holds for case-based reasoning, because the decision in an old case is only relevant for a new case if one employs the principle that similar cases

are to be treated similarly.[11] Moreover, the identification of the relevant factors in a case presupposes principles.[12]

Normally, a rule will be applied and its conclusion follows, if its conditions are satisfied. Sometimes, however, a rule should not be applied, even though its conditions are satisfied. If such a situation occurs, the conclusion of the rule does not follow. For instance, the rule that thieves are punishable is normally applied if somebody is a thief. The conclusion that this person is punishable follows 'by default'. However, if this person turns out to be insane, the rule should not be applied and the conclusion that this insane person is punishable does not follow.

Principles only lead to provisional conclusions, and only after balancing the reasons based on all relevant principles can the definitive conclusion be drawn. For instance, thieves ought to be punished and the fact that somebody is a thief is a reason why this person ought to be punished. As long as no other relevant information is considered, the conclusion should be that this person ought to be punished. If this person turns out to be a minor, however, there is also a reason why this person ought not to be punished. Only after weighing the reasons for and against punishing, the conclusion can be drawn whether this minor thief ought to be punished. The result of this weighing of reasons may be that our minor thief ought not to be punished.

In both cases, when the application of a rule is blocked and when a reason based on a principle must be weighed against other reasons, the addition of new information (an exception to a rule, or the applicability of a colliding principle) can take away the justification of a conclusion that was previously justified.[13] As my use of the word 'new' in the previous sentence already indicated, defeasibility of arguments is strongly connected with a procedural view of reasoning. In this respect, defeasibility differs from the notion of non-monotonicity, with which it is sometimes identified. (Non-)monotonicity is a characteristic of a system of logic. If a logic is monotonic, the valid conclusions of a theory are a subset of the valid conclusions of every superset of this theory. This definition does not involve the notion of time, let alone of a procedure. Defeasibility, on the contrary, becomes relevant with an increase of information over time. At a certain moment in time, when a particular amount of information is available, it is justified to draw some conclusions. At a later moment, when more information has become available, not all of these previously justified conclusions can be justified anymore, either because the rule on which they are based should not

[11] See chapter 3, section 13.
[12] Kaptein 1995.
[13] See chapter 1.

be applied, or because new reasons against the conclusion have become available.[14]

Although defeasibility is connected with the idea of time and therefore also with the idea of a process, it does not automatically lead to the notion of a procedure, let alone a dialectical procedure. For instance, the acquisition of knowledge by a single person over time will involve the defeat of previously drawn conclusions. Often, however, the defeat of an argument and its conclusion will be based on new information introduced by one's opponent in a debate. That makes it particularly attractive to use a dialectical way of characterizing defeasible reasoning.

3.1 Battles of arguments

Such a dialectical way of characterizing defeasible reasoning has recently become rather popular. Several authors have modeled defeasible reasoning as a battle of arguments.[15] Given a set of premises and some underlying logic, it is possible to formulate a number of arguments that lead to different conclusions.

Arguments can be in conflict in basically two ways.[16] First, it is possible that the conclusions of two arguments are incompatible.[17] This would be the case if there are conflicting applicable principles. Then, the weaker of the two arguments is defeated.[18] It is also possible that an argument directly attacks another argument, without having an incompatible conclusion. An argument may, for instance, lead to the conclusion that a rule employed in another argument suffers from an exception, without saying anything about the conclusion of that other argument. In that case the attacked argument is defeated.

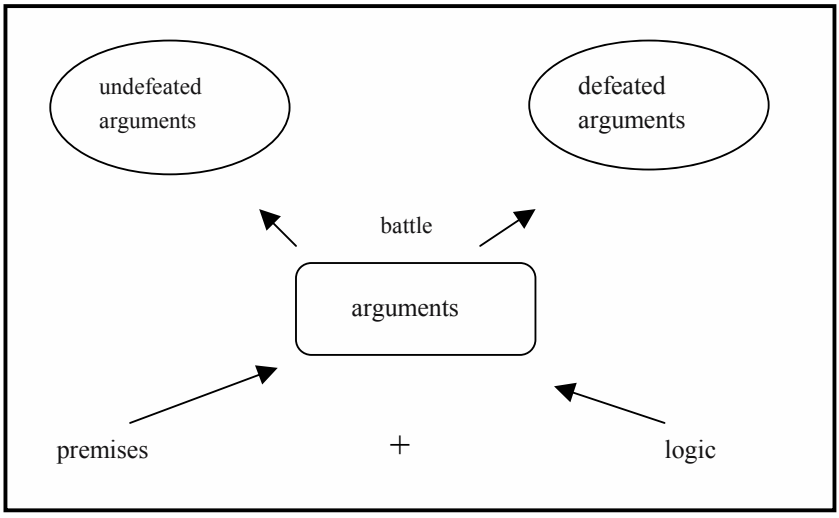
[14] The temporal aspect of defeasible reasoning is emphasised in Verheij's CumulA-model. Verheij 1996, 107f.

[15] Proponents of this view are Loui 1987, Pollock 1987 and 1994, Vreeswijk 1993, Dung 1995, Verheij 1996 and 2003 (DL) and in the field of AI and Law, Gordon 1994 and 1995, Sartor 1994 and Prakken 1997.

[16] The following characterization of defeat abstracts from many different concrete logics and does not necessarily conform to any one of them, although - I think - it captures the spirit of most of them.

[17] The notion of incompatibility is left open to further definition. Logical inconsistency is an obvious candidate to be a form of incompatibility. The relation between incompatibility and inconsistency is discussed more elaborately in chapter 5, section 3.

[18] Which argument, if any, in a conflict is the weaker, needs further specification in a domain theory.



The picture is complicated a little because an argument can only defeat another argument if it is itself undefeated. As a consequence, the question whether an argument is defeated can only be answered by considering sets of arguments. One set consists of defeated arguments, the other of undefeated arguments.[19] The basic idea behind this approach is that the set of conclusions that can validly or justifiably be drawn from a set of premises by means of the underlying logic consists of the conclusions of the undefeated arguments.[20] Take, for instance, the following example[21]:

I. Mary testified that John is a thief.
II. It is well-known that Mary often lies.
III. John is a minor.
IV. John is a repeat-offender.

Moreover, the following principles are valid:

[19] The variant where a battle of two arguments remains undecided is also possible. In that variant the arguments and their conclusions are divided into three categories: justified, defensible and overruled. Cf. Prakken and Sartor 1996.

[20] In the case of defeasible argumentation, the notion of the validity of an argument becomes ambiguous. Defeasible arguments are not valid in the traditional semantic sense that the truth of the premises guarantees the truth of the conclusion. They may still be valid in the sense that their conclusions are justified by their premises. Those who want to stick to the semantic notion of logical validity must choose another term for the goodness of defeasible arguments. That is why I wrote about conclusions that can validly *or justifiably* be drawn. See also chapter 1, section 5 on the nature of logic.

[21] For the sake of a clear presentation, I made some sacrifices on logical precision.

a) Somebody is a thief, if there is a testimony to that effect.
b) Testimonies of persons who are well-known liars should not be taken into account.
c) Thieves ought to be punished.
d) Minors ought not to be punished.
e) The fact that somebody is a minor is considered to be a stronger reason against punishing this person, than the fact that this person is a thief is a reason for punishing.
f) If somebody is a repeat-offender, his or her minority is disregarded.
g) Normally, nobody should be punished.
h) If somebody is a thief, there is an exception to principle g.

Given these facts and principles, the following arguments are possible:

1. Mary testified that John is a thief. Therefore John is a thief. Therefore John ought to be punished. For the same reason, there is an exception to principle g.
2. It is well-known that Mary often lies. Therefore Mary's testimony ought to be disregarded.
3. John is a minor, therefore John ought not to be punished.
4. John is a repeat-offender. Therefore his being a minor ought to be disregarded.
5. Being a minor outweighs being a thief. Therefore argument 3 defeats argument. 1.
6. Nobody should be punished. Therefore John should not be punished.

Argument 4 defeats argument 3. As a consequence argument 3 cannot defeat argument 1 anymore, as it would in principle do because of argument 5. It seems therefore that John ought to be punished, because he is a thief and there is an exception to principle g. However, the argument leading to the conclusion that John is a thief is defeated because it is well-known that Mary often lies. As a consequence it turns out that argument 6 is not defeated and that John ought not to be punished. The arguments are divided as follows:

Undefeated	Defeated
2) It is well-known that Mary often lies. Therefore Mary's testimony ought to be disregarded.	1) Mary testified that John is a thief. Therefore John is a thief. Therefore John ought to be punished. Also therefore, there is an exception to principle g.
4) John is a repeat-offender. Therefore his being a minor ought to be disregarded.	3) John is a minor. Therefore John ought not to be punished.
6) Nobody should be punished. Therefore John should not be punished.	5) Being a minor outweighs being a thief. Therefore argument 3 defeats argument. 1.

3.2 Static dialectics

In Prakken and Sartor 1996, the above view of defeasible reasoning as a battle of arguments is cast in a dialectical shape. The conclusion of an argument holds as long as no defeating counterargument is produced. If such a counterargument is produced, the original conclusion can be reinstated by producing a counter$_2$argument. A counter$_3$-argument would then defeat the conclusion again and so on.

One can imagine a debate between two parties where each party is allowed to defend some thesis by providing an argument that has this thesis as its conclusion. Moreover, they are also allowed to produce counterarguments to their opponent's arguments. For instance, the public prosecutor (PP) adduces argument 1 to the effect that John ought to be punished. This argument would defeat basic argument 6 to the effect that John ought not to be punished. The defense produces counterargument 3 in combination with argument 5 to the effect that argument of the PP does not hold. This counterargument reinstates basic argument 6. The PP counterattacks with argument 4, thereby reinstating argument 1. Then the defense comes with argument 2, thereby reinstating argument 6.

Given a set of premises and a system of logic, there may be a winning strategy to defend a particular conclusion. In the above example, for instance, there is a winning strategy for the conclusion that John ought not to be punished. Valid conclusions can then be defined as conclusions for which a winning strategy obtains. This is the counterpart in non-monotonic logic of the definition of the logical operators in terms of dialogues.

Notice that this kind of dialectics assumes a fixed set of premises and implicitly (because of the notion of a winning strategy) deals with all

arguments that are possible given these premises. In fact, there is a clear parallel with the way in which Lorenzen and Lorenz employed dialectics. In both cases, the purpose of the dialectics is to clarify the notion of logical validity. This explains that a fixed set of premises is assumed and that all possible dialogues are taken into consideration.

Nevertheless there are also important differences. The battle of arguments approach is not committed to a particular logic. The notion of validity with which it is concerned is not the validity of an argument within such a system of logic, but rather the status of an argument on the basis of a framework that deals with the battle of arguments. This framework presupposes the internal validity of arguments. As a consequence, the dialogue steps deal with arguments as a whole and not with the steps of a logical proof, unless the steps of the logical proofs may define subarguments, which are in their turn relevant for when one argument defeats another one. Moreover, the dialogues do not characterize the meanings of logical operators, but rather a theory of when one argument defeats another argument.

Because this form of dialectics assumes a fixed set of premises and takes all possible dialogues into account, the notion of time plays no role in it. That is why I propose to call this form of dialectics *static*.

3.3 Dynamic dialectics

As the above discussion of static dialectics illustrates, modeling defeasibility as a battle of arguments does not automatically lead to a dynamic approach. However, Prakken developed a four-layered model of legal argument, in which dynamics plays a crucial role.[22] The four layers in Prakken's model consist of a system of logic, a dialectical layer, a procedural layer and a strategical layer. Given a set of premises, the logic determines the set of possible arguments. The dialectical layer then sorts out the arguments into the defeated and the undefeated ones. The procedural layer determines how the set of premises, which functions as input to the logic and the argumentation framework, can evolve in time. The procedural rules of the third layer regulate how an actual dialog can be conducted. These rules allow dialogue parties for instance to add new premises, or to retract premises that turn out to be indefensible. The fourth layer deals with strategy, which argument moves that are allowed by the third layer should be made to reach the arguers goals.

[22] Prakken 1997, 270f.